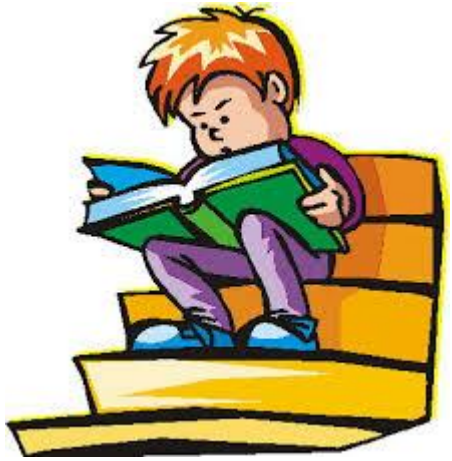
Implicit statistical learning:

Effects of a word-picture training on reading and spelling in elementary school children and youths with intellectual disabilities



Katja Margelisch

Overview

1) Important elements of reading instruction
2) Sight words / implicit statistical learning
3) General aims of the training-studies
4) Study 1
5) Study 2
6) Summary

Reading instruction: What are the major findings?

Most children need explicit instructions in decoding and comprehension (e.g. Chall, 1983; Johnson, 2013).

While fluency isn't sufficient for comprehension, it is absolutely necessary for good comprehension (e.g. Johnson, 2013).

Spelling and reading are highly related, especially in the early stages of learning to read (e.g. Fletcher-Flinn et al., 2004).

Children should spend more time independently reading and writing (e.g. Fletcher-Flinn et al., 2004).

Children not reaching benchmarks benefit from daily intensive instruction (e.g. Johnson, 2013).

4 different ways to read words (Ehri, 2005)

1) **Decoding:** sound out and blend graphemes into phonemes / work with larger chunks of letters to blend syllabic units into recognizable words

2) **Analogizing:** Using words we already know to read new words (e.g. «Bottle» -> «throttle»)

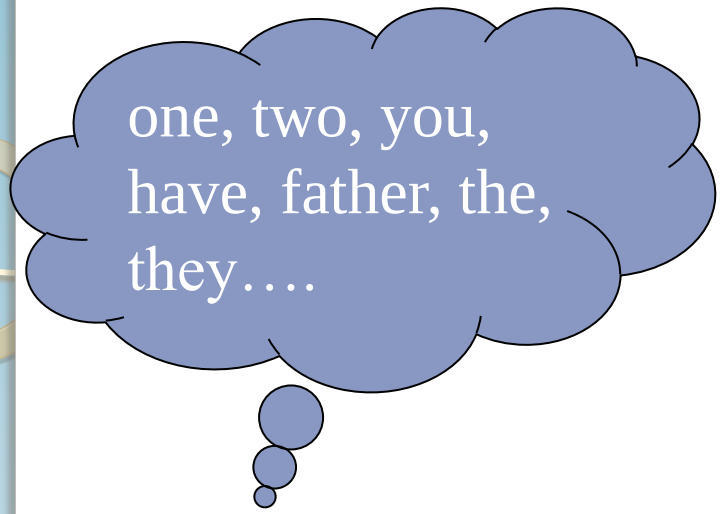
3) **Prediction:** Using context and letter clues to guess unfamiliar words

4) **Reading words by memory or sight**: Words we have read before -> we can just look at them and our brain recognizes them.

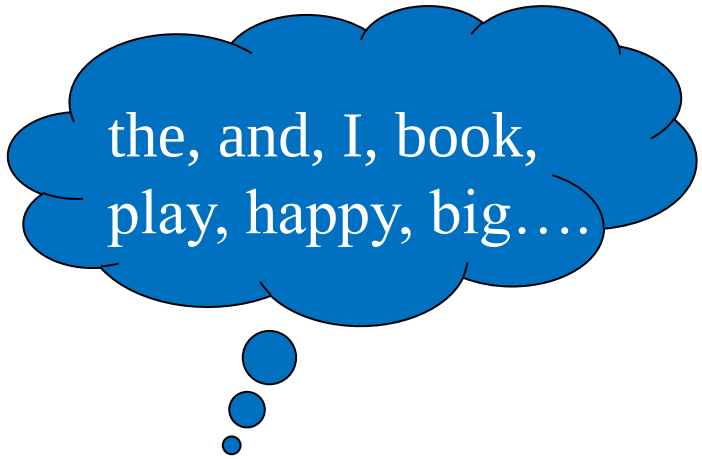
Sight word reading (based on implicit statistical learning)

- When readers see the word, the word's identity is triggered in memory very rapidly (Ehri, 2005)
- Readers can recognize the pronunciations and meanings of well known sight words automatically (LaBerge & Samuels, 1974)
- If readers know words by sight and can recognize them automatically, then word reading operates unconsciously. All other ways of reading words requires conscious attention.

- Poor readers have difficulties with sight word reading (Ehri, 2005)



Words that cannot be *phonically* produced



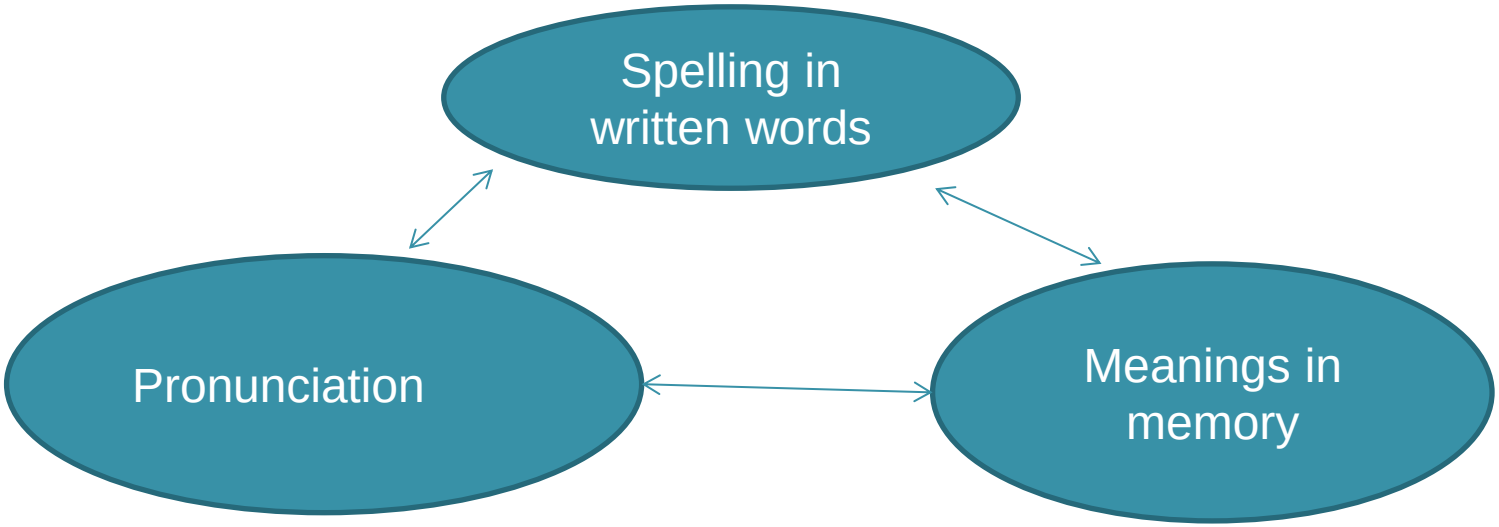
High-frequency words

Words of *special interest*

The role of implicit statistical learning in reading acquisition

1) It has been demonstrated that there is a rich statistical structure in both oral and written language (Arciuli & Simpson, 2012).
2) Implicit learning processes seem to be largely independent of age and IQ (Don et al., 2003; Vinter & Perruchet, 2000).
3) The acquisition of an artificial language proceeds more effectively when it contains the types of statistical structure found in natural language (as reviewed by Gómez & Gerken, 2000).
4) Some studies have indicated that individuals with language-based impairments like dyslexia show deficiencies in implicit learning (Grunow et al., 2006; Tomblin et al., 2007).

Side word learning: an connection-forming process

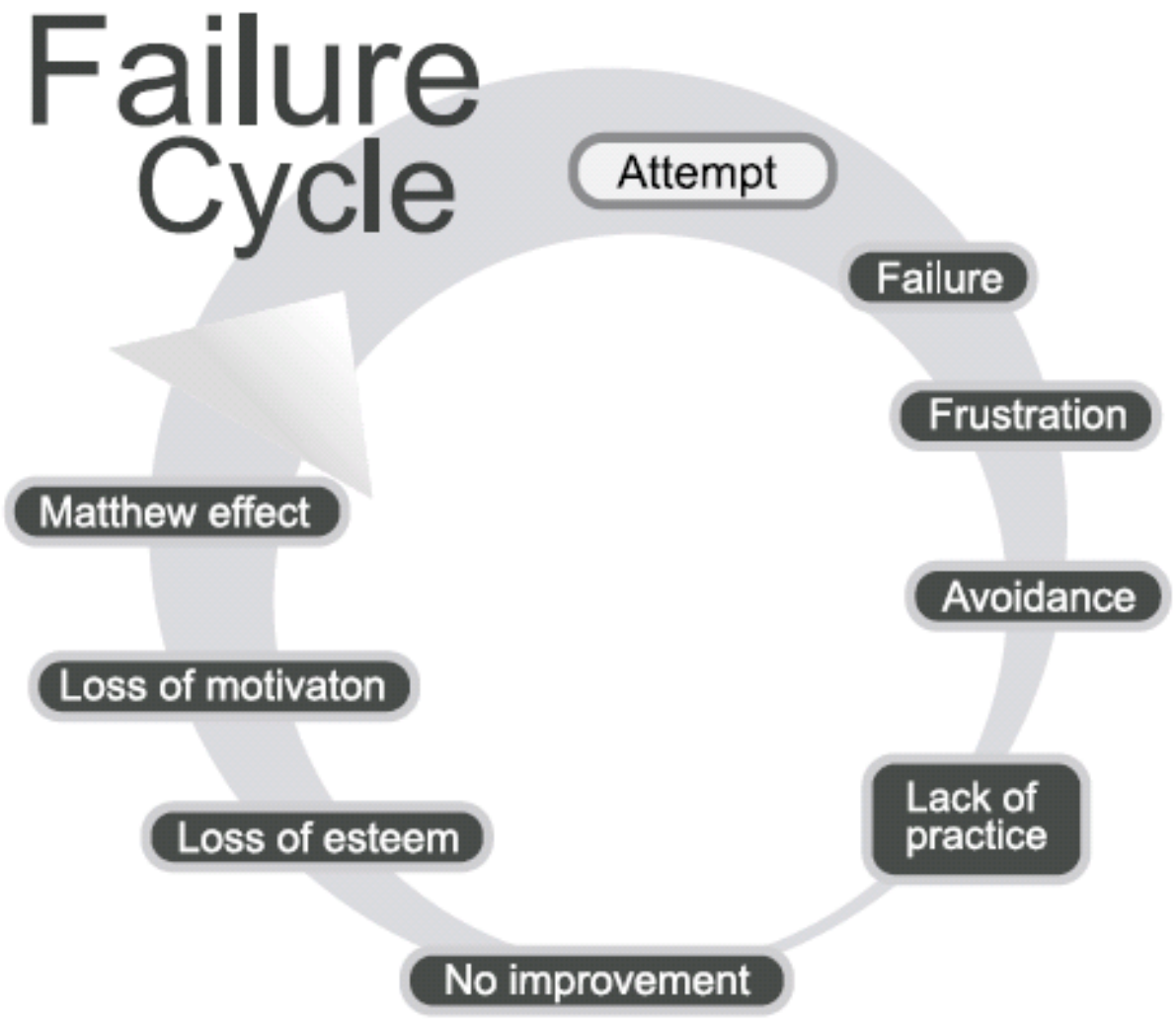


There is convincing evidence that phonological, orthographic and semantic processes influence children's ability to learn to read and to spell words. (Wang et al., 2011).

By frequent reading, children acquire implicit knowledge about the frequency of letter patterns in written words, and they use this knowledge during reading and spelling (Pollo et al., 2009).

Additionally, semantic connections facilitate the storing of words in memory (Wang et al., 2011).

Reading acquisition



Major training principles

- Additional problems of children with reading / spelling problems: avoidance behavior; Improvement of endurance with computer-based trainings (von Suchodoletz, 2007)
- Training-programs should be adjusted depending on the current performance, experiences of success and immediate feedback are important for progress (von Suchodoletz, 2007)
- Individual exercise blocks should not take longer than 15 min, playful elements are recommended (von Suchodoletz, 2007)
- Current orthographic knowledge can promote and encourage orthographical learning (Cunningham et al., 2002)
  ⇨ Transfer

Trainingstyp: ImplOrth

Game Level: 2

Dauer: Minuten

14

Stop

lesen

Trainingstyp: ImplOrth

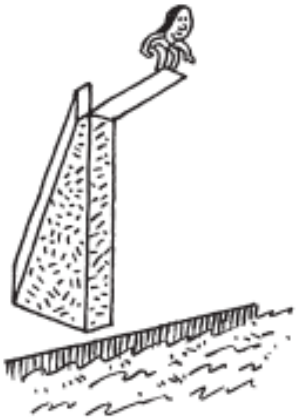
Game Level: 2

Dauer: Minuten

29

Stop

hoch



Trainingstyp: ImplOrth

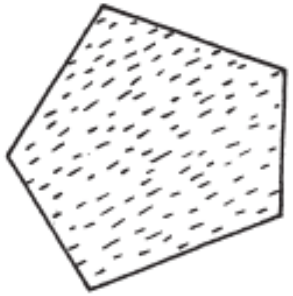
Game Level: 2

Dauer: Minuten

03

Stop

Pinsel



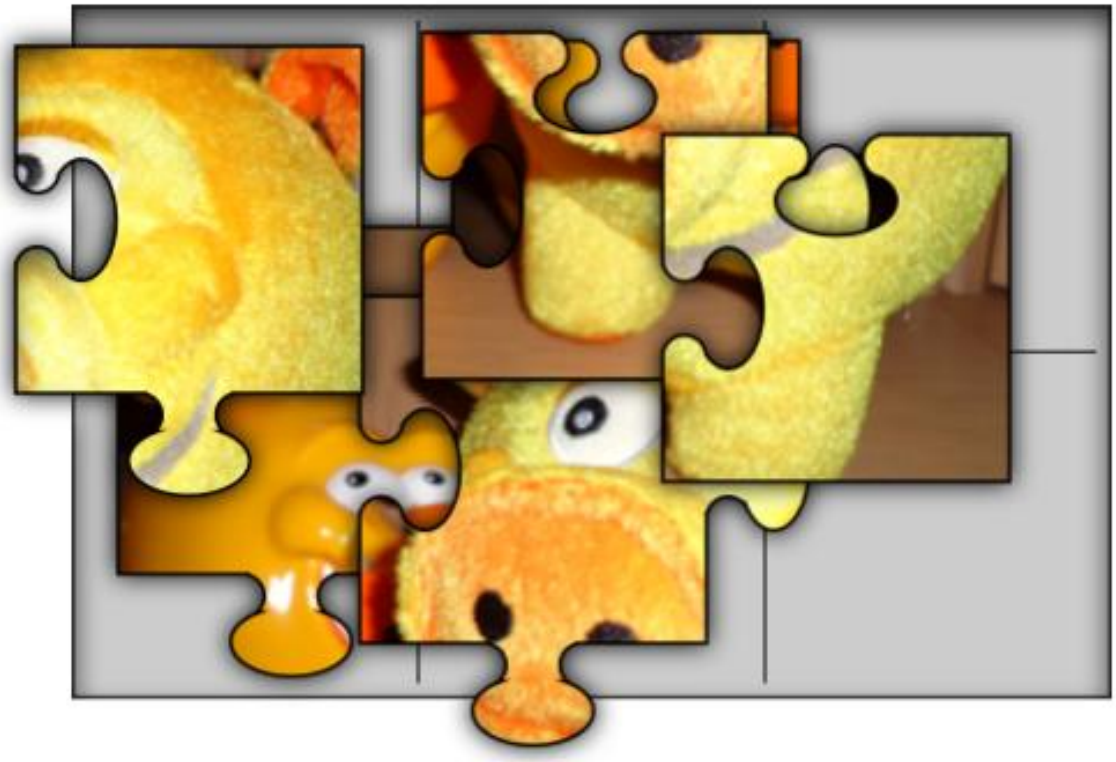
Trainingstyp: ImplOrth

Game Level: 2

Dauer: Minuten

25

Stop



General aims

We investigated the effects of a word-picture training (WPT) which is based on statistical and semantic learning on reading in healthy elementary school children and children who are suffering from learning difficulties and / or intellectual disabilities.

Study 1:
COGNITVE INTERVENTIONS IN SWISS SCHOOLS (ciss)

Studer, Barbara -> Brain Twister (BT)
Törmänen, Mina -> Audilex (AL)
Margelisch, Katja -> Word-Picture-Training (WPT)
Mendelowitsch, Sarah

Eckstein, Doris
Kodsdabashev, Stefan
Perrig, Walter

Masterstudents
Meili, Valentina
Urwyler, Claudia
Ritter, Jeanine

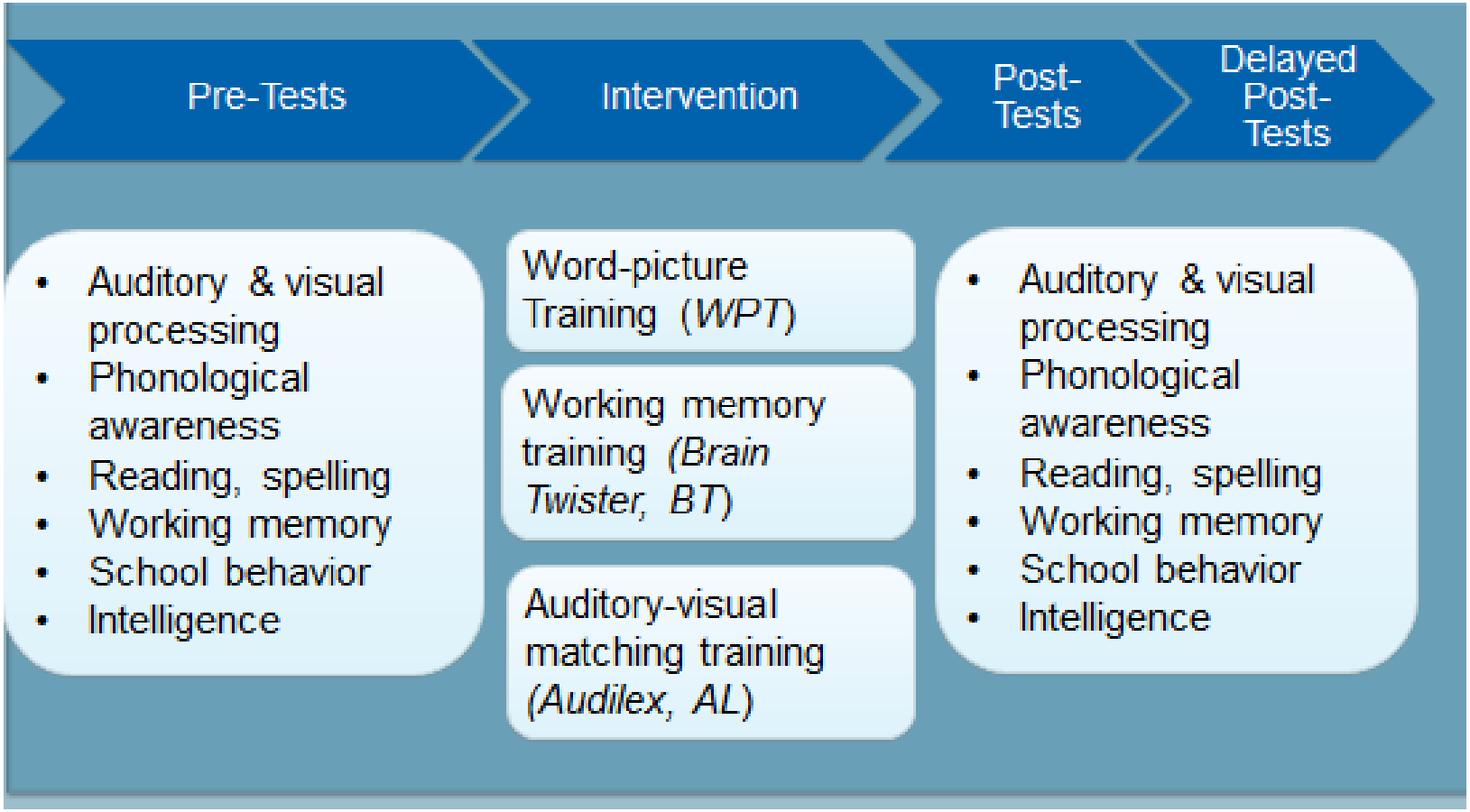
Research assistants
Wyss, Harro
Von Dach, Christa
Hogrefe, Antonia

CISS: Methods

132 children from regular elementary schools in Switzerland

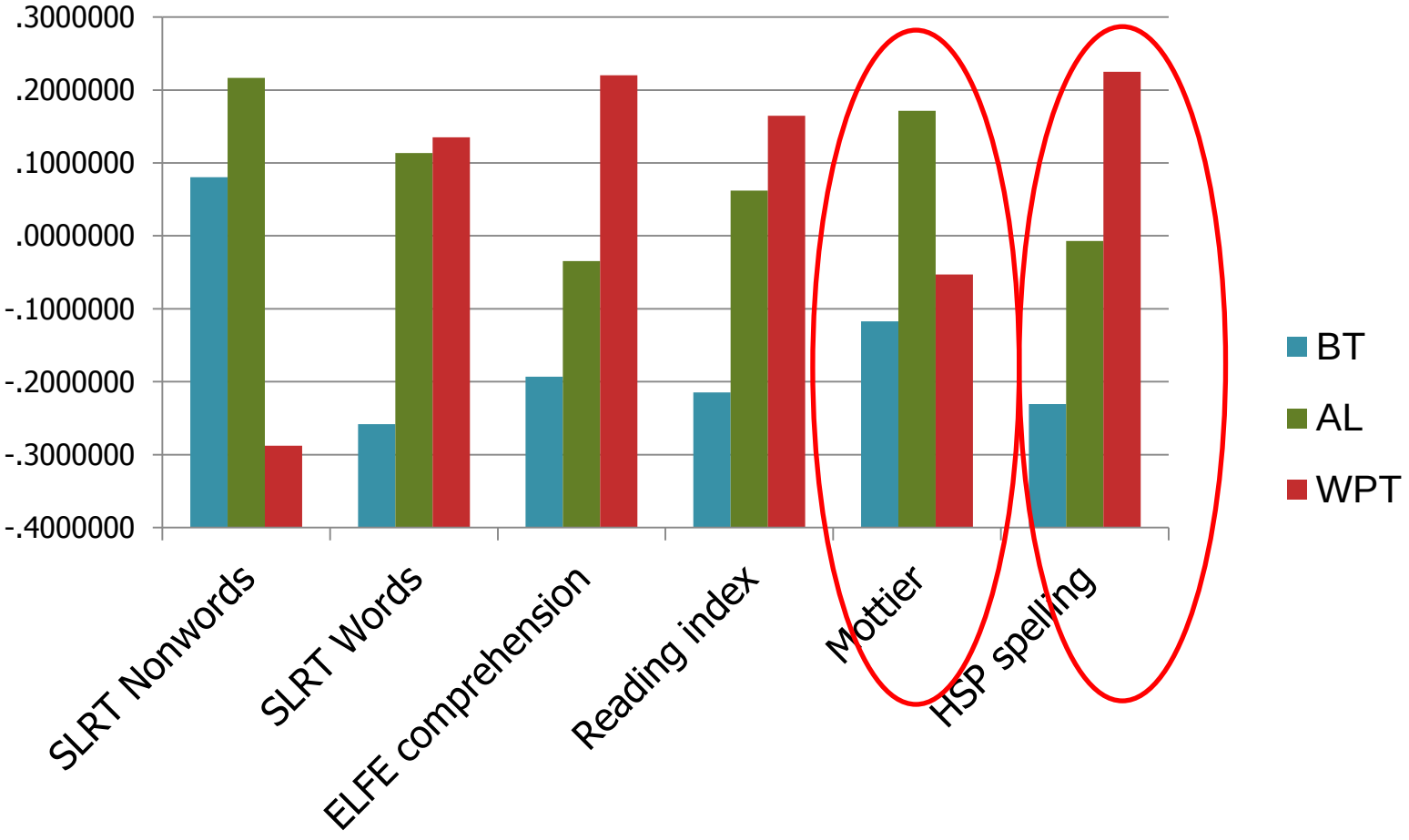
- 8-11 years old (2nd, 3rd or 4th graders)
- focused on whole school class interventions
- studying pupils with *diagnosed* learning disabilities or *not diagnosed* learning difficulties

CISS: Methods

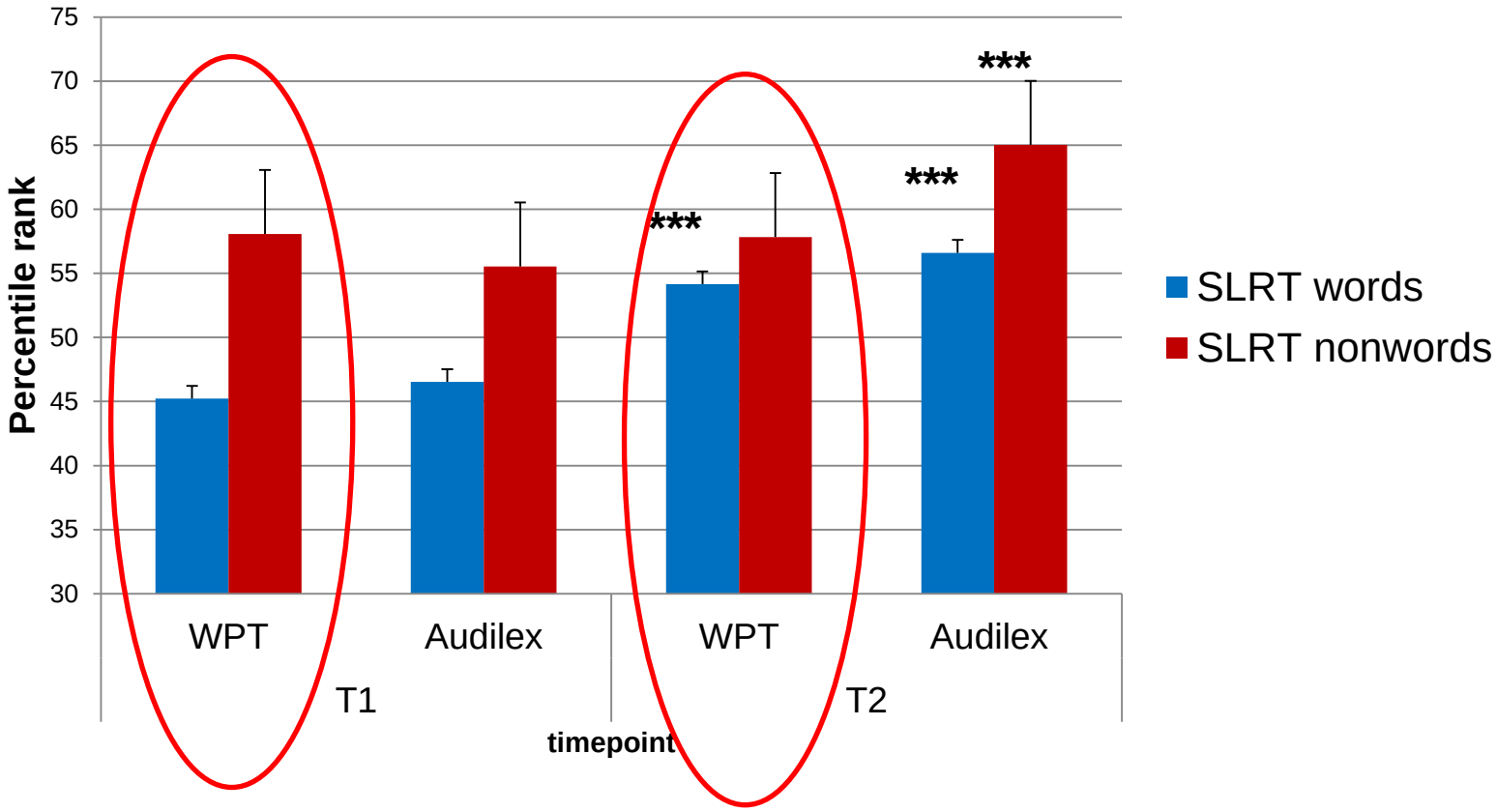


Training: 3x / week, 15min / session, during 8 weeks
= 24 training sessions with educator or psychologist

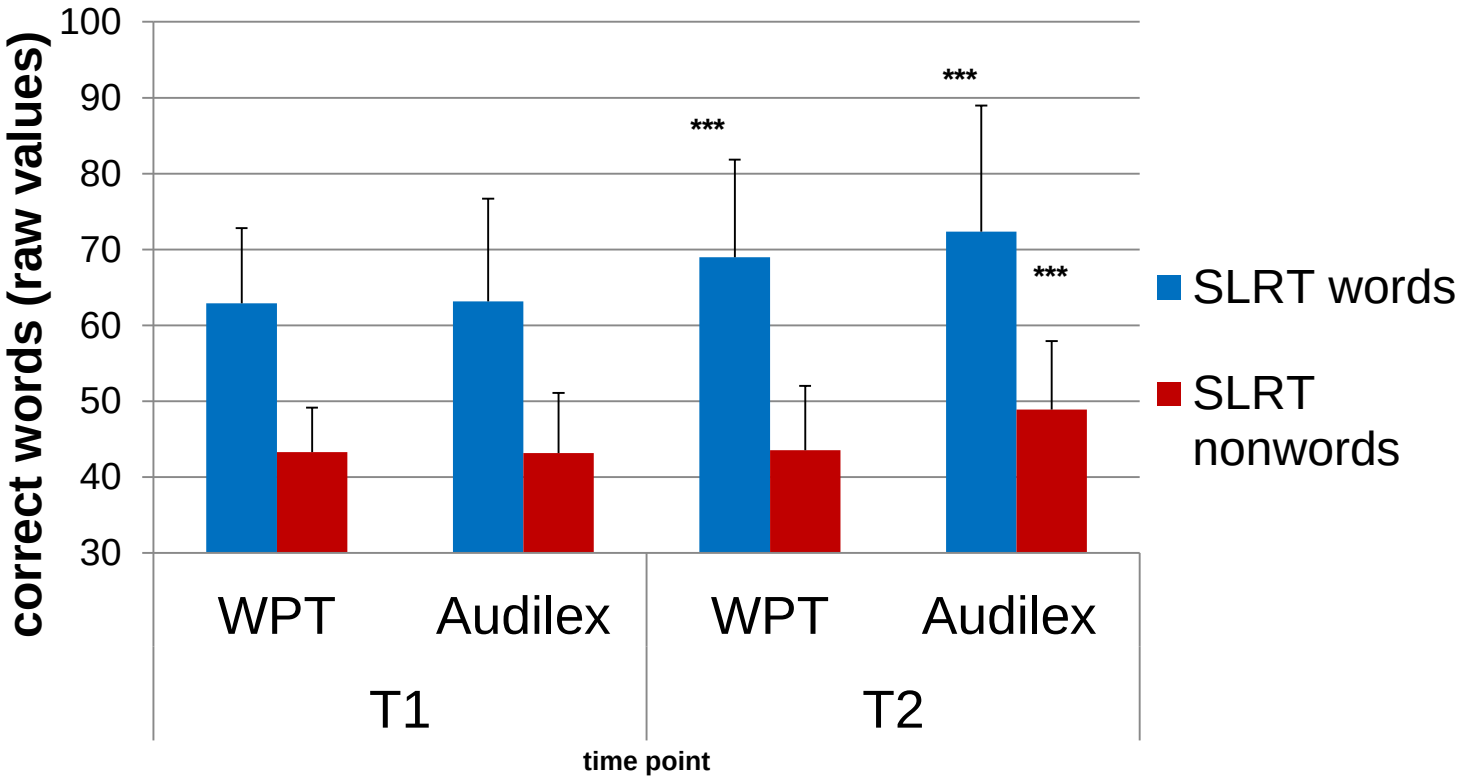
Gains (z-values) in reading, phonological processing and spelling



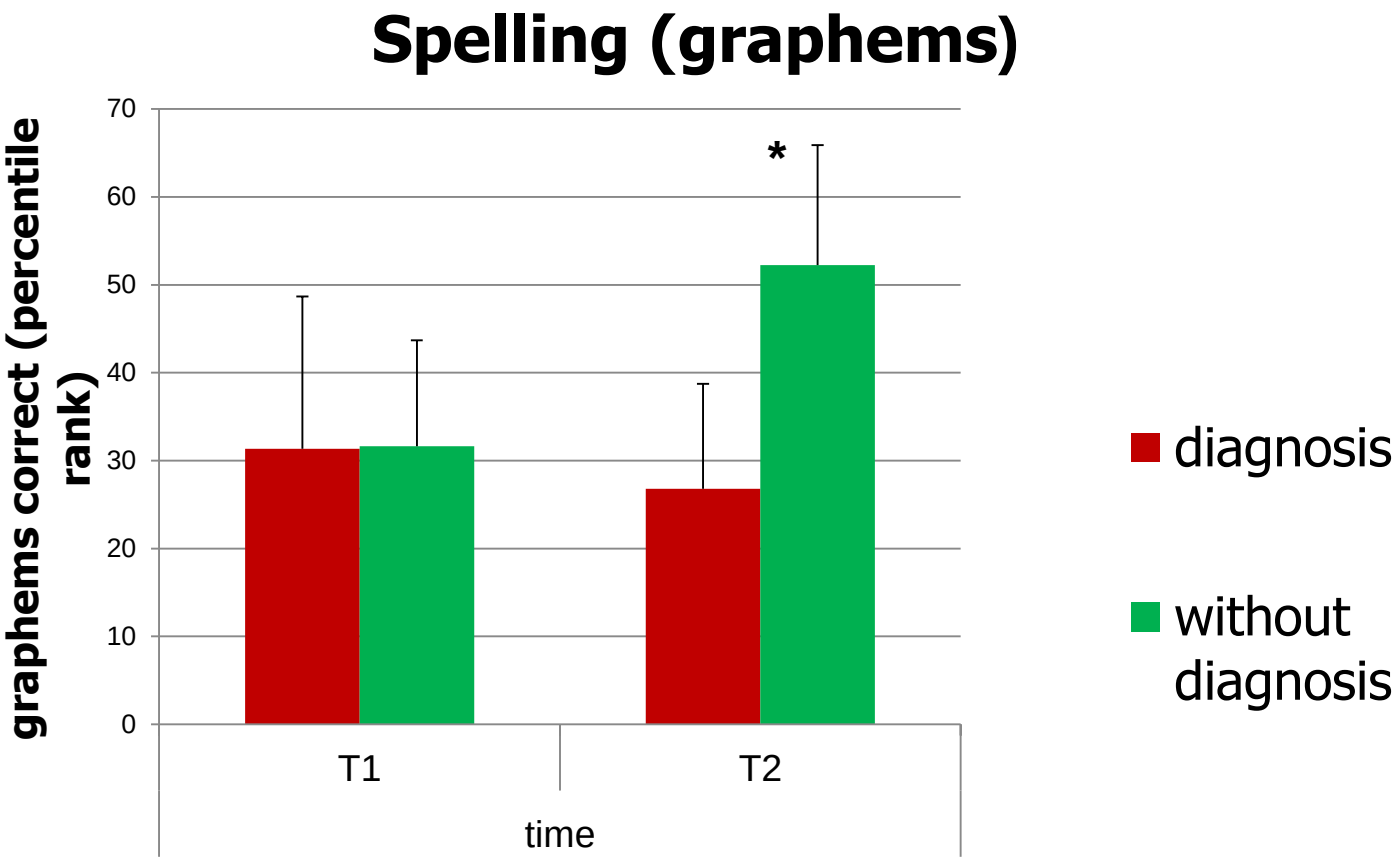
Word / nonword reading accuracy



Word / nonword reading accuracy

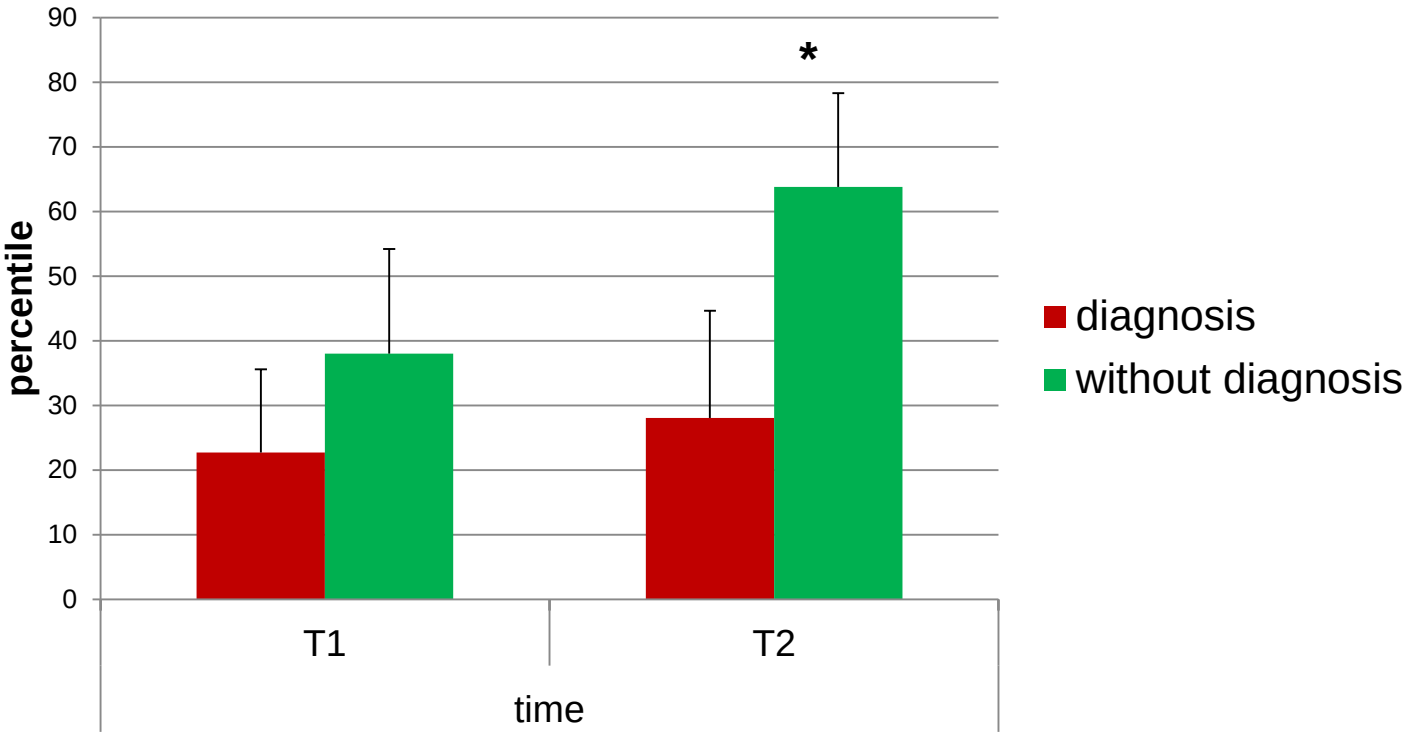


Children with language-based learning disabilities; (n=6) vs. Childern without diagnoses (n=38)



Within the word-picture intervention group, children without diagnosed learning disabilities profited more in spelling as children with diagnosed language-based disabilities.

reading comprehension



Children without learning difficulties benefited more in word comprehension as children with learning difficulties.

Summary Study 1

The word-picture training and the auditory-visual matching training led to substantial gains in reading and spelling performance in comparison to the working-memory training.

The word-picture-training program led to differential effects for children with / without learning difficulties:

Children without learning difficulties profited more in spelling and word comprehension as children with learning-difficulties. No group differences were found in reading accuracy gains.

Do individuals with language-based impairments like dyslexia show deficiencies in implicit statistical learning?

Is implicit statistical learning also possible for children with intellectual impairments? -> second study

Study 2: «Word-Bild-Training» (WOBIT; for word-picture-training in german) in curative schools with children and youths with intellectual disabilities

Margelisch, Katja
Perrig, Walter

Masterstudent
Heldner, Dajana

Research stage
Kürsteiner, Sandra

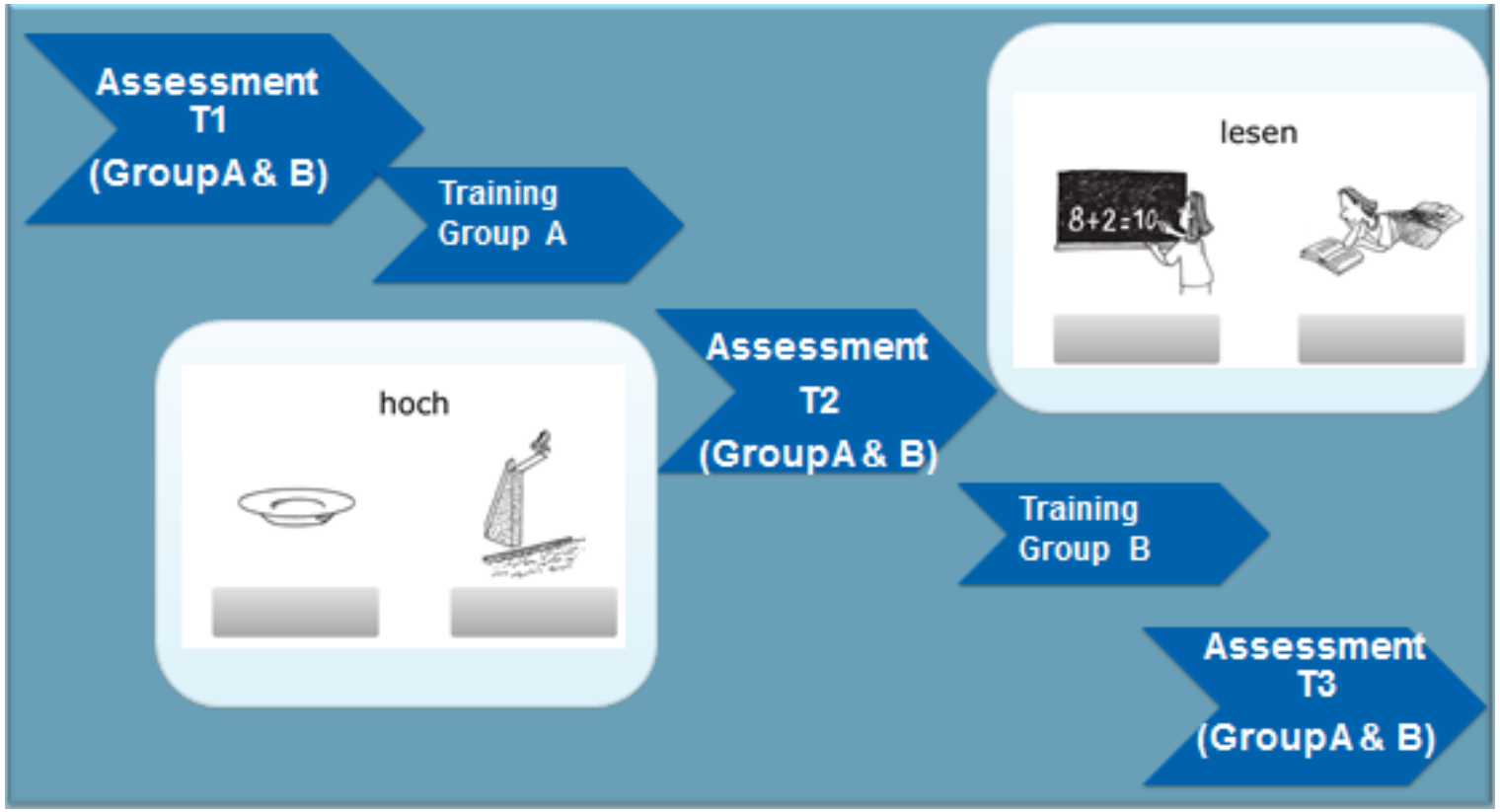
Research assistant
Hogrefe, Antonia

WOBIT: methods

50 children and adolescents from curative education schools in Switzerland with intellectual disabilities (IQ < 75).

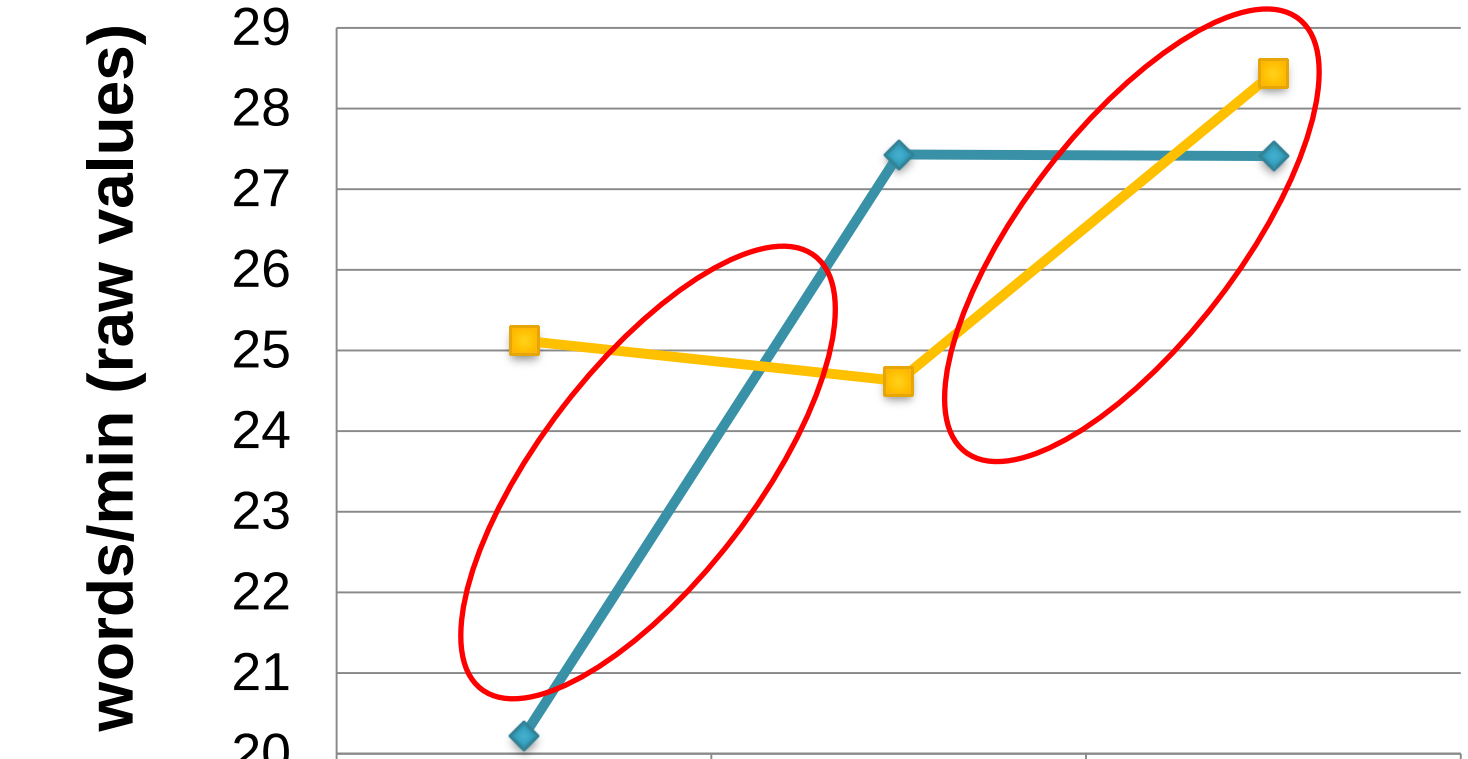
- 9-18 years old
- 2 training groups (waiting control group design)
- Test battery (T1, T2, T3): phonological awareness, reading, spelling, attention, intelligence, verbal memory, school behavior

WOBIT: method



Training: 5x / week, 15min / session, during 4 weeks
= 20 training sessions with educator or psychologist

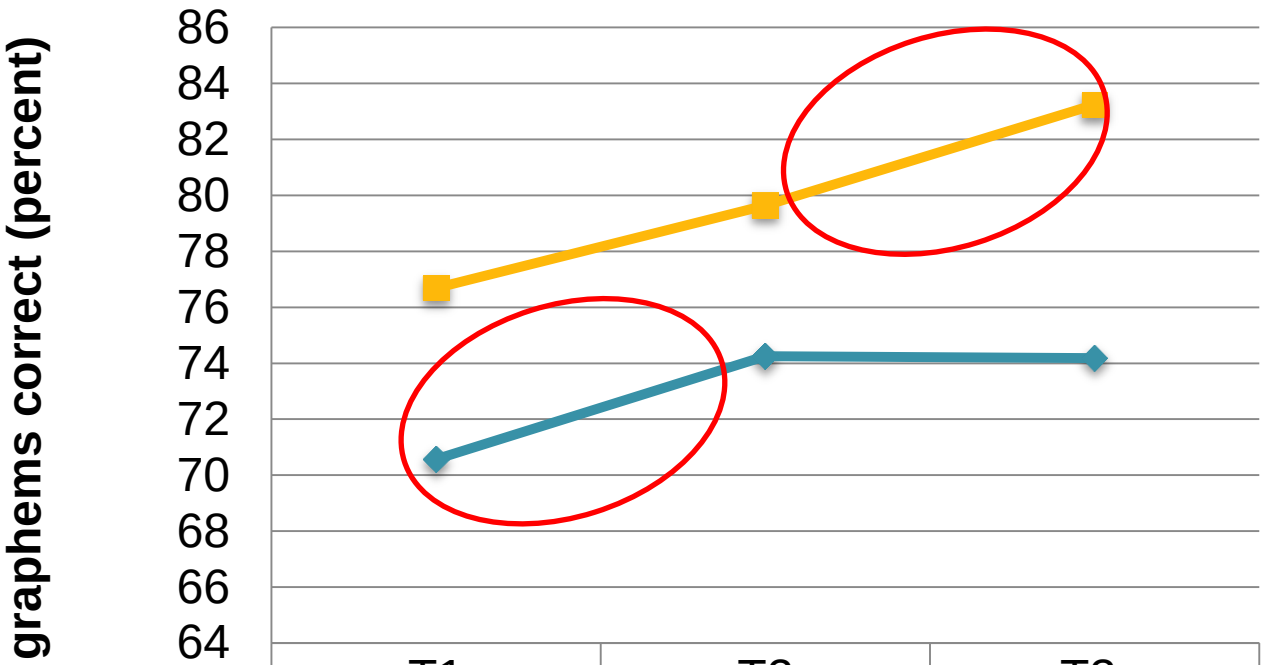
reading accuracy (T1, T2, T3)



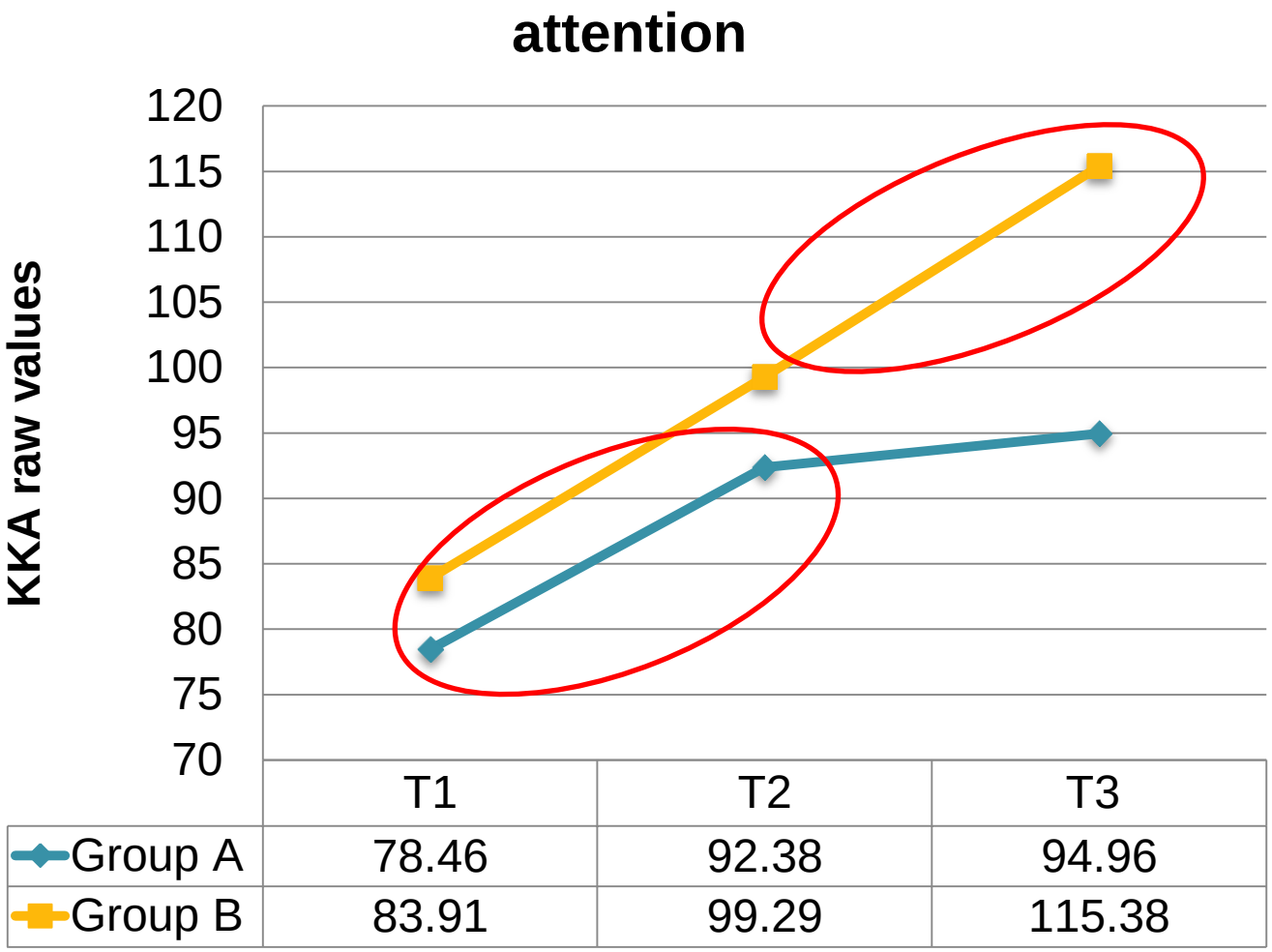
	T1	T2	T3
Group A	20.22	27.43	27.41
Group B	25.12	24.62	28.44

The word-picture training led to substantial gains in reading. The effects were preserved six weeks later.

Spelling (Graphems)



	T1	T2	T3
Group A	70.57	74.25	74.18
Group B	76.69	79.64	83.24



	T1	T2	T3
Group A	78.46	92.38	94.96
Group B	83.91	99.29	115.38

Results Study 2

The word-picture training led to substantial gains in reading (also after controlling for gender, age, intelligence, attention, and phonological awareness). The effects were preserved six weeks later.
No significant effects were found in spelling.
The computer-based training led to substantial gains in attention.

Summary

Implicit learning processes like statistical learning seem to be largely independent of IQ and age.

Children with language-based impairments could show deficiencies in implicit statistical learning.

Our findings highlight the need for frequent reading trainings with semantic connections in order to support the acquisition of literacy skills.

for your attention!